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seems to lie in another suggestion made by Dr. Trumpler, namely, systematic errors in spectral classification. The stars concerned are faint, ranging from the 9th to the 11th photographic magnitude; the classification therefore depends on low-dispersion spectrograms, and the conditions are thus favorable for the appearance of an error depending on magnitude. The Mount Wilson color indices for the stars at large, on the other hand, were derived from bright objects whose spectra are easily and accurately determined.

That a magnitude error in the spectral types actually enters is suggested by the group of A0 *Pleiades,* which extends over the interval 6.7-9.0. The results of the three observers are here again in agreement in showing a gradual and nearly parallel increase in color index with magnitude, amounting to about 0.2 mag. This apparently is to be attributed to increasing difficulty of classification, since for A0 stars in general there is no evidence of a dependence of color upon luminosity. A similar result is found also for the B9 group, and is at least suggested in the case of the A2 stars; but for the latter the range in magnitude is too small to make the change in color conspicuous. The B5 and B8 stars are all brighter than 6.5, so that a magnitude effect is scarcely to be expected, and in fact does not appear.

The large positive differences in the last column of Table II cannot be entirely due to errors in the color indices, for although the values in Table I are provisional, there is ample evidence that they are not far from the truth. The differences in question correspond to a spectral interval or more, and are very similar to those appearing in Schwarzschild's comparison[4] of the *Revised Harvard Photometry* with Miss Cannon's results for 1477 stars in *Harvard Annals,* **56**, IV.

F. H. SEARES.

DISCOVERY OF BRIGHT HYDROGEN LINES IN THE SPECTRUM OF THE VARIABLE STAR W CEPHEI

In carrying out the program for the detection of a bright Hα line in B type stars, undertaken by Mr. Merrill and the writer with the 10-inch Cooke telescope, the variable star W *Cephei* was found to have Hα bright on objective-prism plates secured on November 2 and 3, 1921.

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[4] *Göttinaen Aktinometrie,* B, pp. 19, 21.

The line is strong, narrow, and well defined. No change in the intensity of the line can be detected on the two dates mentioned. The star has been classed as a possible *Cepheid*.[1] Harvard College Observatory gives the spectral type as K with a range of magnitude from 7.3 to 8.3. Observations of the light-curve by several observers would seem to show that it is irregular.

A slit spectrogram, taken by Mr. Merrill with the 100-inch telescope on November 14, 1921, shows Hα and Hβ bright.

M. L. HUMASON.

NOTE ON INVISIBLE SUN-SPOTS†

All available evidence, including the invariable presence of a magnetic field, the radial motions of the superposed gases observed at various levels, the inflow of neighboring prominences, and the structure of the hydrogen (Hα) flocculi, indicate that sun-spots are vortex phenomena, somewhat analogous to terrestrial tornadoes. The visibility of a spot, on this hypothesis, depends upon the degree of cooling produced by the expansion of the gases in the vortex. If this is sufficiently great, a dark cloud appears, which we recognize by direct visual observation. However, there may be stages in the life of a spot, during the period of formation or disintegration, when the cooling thus produced is insufficient to cause a visible change in the brightness of the photosphere. If the vortex, which is here regarded as the essential element of the spot, is actually present at such times, it might be detected through the Zeeman effect of its local magnetic field.

The phenomena of recurrent spots, and those of bipolar groups in which the minor member appears and disappears within short intervals of time, suggest the same possibility, and

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[1] Shapley, *Mt. Wilson Contr.*, No. 153.

†I have hesitated to use the term "invisible sun-spot," but it seems to be the simplest means of designating the invisible stage of spots which are usually visible during the greater part of their existence. A spot invisible to the eye, but rendered apparent on a photograph (if feasible) through the increased contrast resulting from the use of ultra-violet light, would undoubtedly be called a sun-spot. In the present case, which differs only in degree, a new term seems no more essential.